

Food

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Arm Forestry

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Farm Forestry

E. J. ZAVITZ

INTRODUCTION.

This bulletin has been prepared to assist the farmer and small landowner of the Province of Ontario to give more rational treatment to the wooded and waste portions of his land.

No space is devoted to arguments showing why the woodlot should be cared for nor why waste lands should be planted. It is assumed that the reader is beyond that stage and desires to make improvements if they can be made in a practical manner.

Through such mediums as the agricultural press, the Farmers' Institutes, and Experimental Union, much has been done to advance the cause of farm forestry. Many prominent men in agriculture have seen the need of conserving a portion of our woodlands and re-planting the non-agricultural soil, which should never have been denuded.

Owing to the peculiar nature of a forest crop, in that it takes so long from the planting to the harvest, the individual is very liable to shirk his responsibility. It has been found in the older countries of Europe that Forestry must have the aid and supervision of the State if anything like a rational policy is to exist. It is fitting that the farmer should receive all possible assistance in improving conditions which will in many cases benefit posterity more than the present generation.

An effort has been made to make this publication practical for the farmer, and as far as possible technical language has been avoided. Various things have been suggested which might not be practical for the large landowner. However, the farmer is especially fitted to carry out work as outlined in these pages, as he has a knowledge of plant life in relation to the soil; he has the equipment for such work and he can personally superintend and give it future inspection.

LIST OF FOREST TREES IN ONTARIO.

Most species of our native trees have synonymous names varying with locality. An example of this is the common maple of Ontario, which is called Sugar Maple, Rock Maple, and Hard Maple. To avoid confusion in this publication it is necessary to agree upon some common name.

Canadian and American species have been given the vernacular and scientific names adopted by Bulletin No. 17, of the Division of Forestry, U. S. Department

of Agriculture. The names adopted in Bulletin 17 are in almost every case known in Ontario; so it has been felt advisable to conform to this standard. One exception is the Hornbeam (*Ostrya virginiana*), which in Ontario is commonly called Ironwood.

The adopted names are given in large type with the synonymous names in parentheses.

TREES INDIGENOUS TO ONTARIO.

<i>Scientific Name.</i>	<i>Common Name.</i>
1. <i>ABIES BALSAMEA</i>	BALSAM FIR. (Balsam; Canada Balsam.)
2. <i>ACER NEGUNDO</i> (<i>Negundo aceroides</i>)	BOX ELDER. (Ash-leaved Maple; Cut-leaved Maple; Negundo Maple; Three-leaved Maple; Manitoba Maple.)
3. <i>ACER NIGRUM</i>	BLACK MAPLE.
4. <i>ACER PENNSYLVANICUM</i>	STRIPED MAPLE. (Moosewood.)
5. <i>ACER RUBRUM</i>	RED MAPLE. (Swamp Maple; Soft Maple; Water Maple; White Maple.)
6. <i>ACER SACCHARINUM</i> (<i>Acer dasycarpum</i>) ..	SILVER MAPLE. (Soft Maple; White Maple.)
7. <i>ACER SACCHARUM</i> (<i>Acer saccharinum</i>) ..	SUGAR MAPLE. (Hard Maple; Sugar-tree; Rock Maple; Black Maple; Maple.)
8. <i>AMELANCHIER CANADENSIS</i>	SERVICEBERRY. (June-berry; Shad bush; Service tree; May cherry; Shad-berry.)
9. <i>ASIMINA TRILOBA</i>	PAPAW. (Custard Apple.)
10. <i>BETULA LUTEA</i>	YELLOW BIRCH. (Gray Birch; Swamp Birch; Silver Birch.)
11. <i>BETULA Papyrifera</i>	PAPER BIRCH. (Canoe Birch; White Birch; Silver Birch; Large White Birch.)
12. <i>CARPINUS CAROLINIANA</i>	BLUE BEECH. (Water Beech; Hornbeam; Iron Wood.)
13. <i>CASTANEA DENTATA</i> (<i>Castanea vesca</i>) (<i>Castanea vulgaris</i>)	CHESTNUT. (Sweet Chestnut.)
14. <i>CELTIS OCCIDENTALIS</i>	HACKBERRY. (Sugarberry; Nettle-tree.)
15. <i>CORNUS FLORIDA</i>	FLOWERING DOGWOOD. (Dogwood; Boxwood.)
16. <i>CORNUS ALTERNIFOLIA</i>	BLUE DOGWOOD. (Dogwood; Purple Dogwood.)
17. <i>FAGUS ATROPUNICEA</i> (<i>Fagus ferruginea</i>) ..	BEECH. (Red Beech; White Beech.)
18. <i>FRAXINUS AMERICANA</i>	WHITE ASH. (Ash; American Ash.)
19. <i>FRAXINUS NIGRA</i> (<i>Fraxinus sambuci-</i> <i>folia</i>)	BLACK ASH. (Hoop Ash; Basket Ash.)
20. <i>FRAXINUS PENNSYLVANICA</i> (<i>Fraxinus pu-</i> <i>bescens</i>)	RED ASH. (Brown Ash; White Ash.)
21. <i>FRAXINUS LANCEOLATA</i> (<i>Fraxinus viridis</i>)	GREEN ASH. (Blue Ash; White Ash.)
22. <i>FRAXINUS QUADRANGULATA</i>	BLUE ASH.
23. <i>GYMNOCLADUS DIOICUS</i> (<i>Gymnocladus</i> <i>canadensis</i>)	COFFEE TREE.
24. <i>HAMAMELIS VIRGINIANA</i>	WITCH HAZEL. (Win'er Bloom.)
25. <i>HICORIA OVATA</i> (<i>Carya alba</i>)	SHAGBARK. (Hickory; Shellbark Hickory; Shagbark Hickory; Shellbark.)
26. <i>HICORIA MU MA</i> (<i>Carya amara</i>)	BITTERNUT. (Hickory; Bitternut; Swamp Hickory; Pig Nut.)
27. <i>HICORIA ALBA</i> (<i>Carya tomentosa</i>)	MOCKER NUT. (Hickory; Whiteheart Hickory.)
28. <i>HICORIA GLABRA</i> (<i>Carya por 'na</i>)	PIGNUT. (Hickory; Bitternut.)
29. <i>JUGLANS NIGRA</i>	BLACK WALNUT. (Walnut; Walnut-tree.)
30. <i>JUGLANS CINEREA</i>	BUTTERNUT. (White Walnut.)
31. <i>JUNIPERUS VIRGINIANA</i>	RED JUNIPER. (Red Cedar; Cedar; Juniper.)
32. <i>LARIX LARICINA</i> (<i>Larix americana</i>)	TAMARACK. (Larch; American Larch.)
33. <i>LIRIODENDRON TULIPIFERA</i>	TULIP-TREE. (White-wood, Yellow Poplar; Tulip Poplar.)
34. <i>MAGNOLIA ACUMINATA</i>	CUCUMBER TREE.
35. <i>MORUS RUBRA</i>	RED MULBERRY.
36. <i>NYSSA SYLVATICA</i> (<i>Nyssa multiflora</i>) ..	BLACK GUM. (Sour-gum; Tupelo; Pepperidge.)
37. <i>OSTRYA VIRGINIANA</i>	HORNBEAM. (Hop hornbeam; Ironwood.)
38. <i>PICEA MARIANA</i> (<i>Picea nigra</i>)	BLACK SPRUCE. (Spruce.)
39. <i>PICEA CANADENSIS</i> (<i>Picea alba</i>)	WHITE SPRUCE.

<i>Scientific Name.</i>	<i>Common Name.</i>
40. <i>PICEA RUBENS</i>	RED SPRUCE.
41. <i>PINUS RIGIDA</i>	PITCH PINE.
42. <i>PINUS STROBUS</i>	WHITE PINE.
43. <i>PINUS RESINOSA</i>	RED PINE. (Norway Pine.)
44. <i>PINUS DIVARICATA</i> (<i>P. banksiana</i>)	JACK PINE. (Scrub Pine; Gray Pine.)
45. <i>PLATANUS OCCIDENTALIS</i>	SYCAMORE. (Button-wood; Plane-tree; Button-ball.)
46. <i>POPULUS TREMULOIDES</i>	ASPEN. (American Aspen; Poplar; Popple.)
47. <i>POPULUS GRANDIDENTATA</i>	LARGETOOTH ASPEN. (Poplar; Popple.)
48. <i>POPULUS BALSAMIFERA</i>	BALM OF GILEAD. (Balsam; Balsam Poplar; Cottonwood; Poplar.)
49. <i>POPULUS DELTOIDES</i> (<i>Populus monilifera</i>)	COTTONWOOD. (Carolina Poplar; Poplar.)
50. <i>PRUNUS SEROTINA</i>	BLACK CHERRY. (Wild Black Cherry; Wild Cherry; Rum Cherry.)
51. <i>PRUNUS PENNSYLVANICA</i>	WILD RED CHERRY. (Pin Cherry; Pigeon Cherry; Wild Cherry.)
52. <i>PRUNUS VIRGINIANA</i>	CHOKE CHERRY. (Wild Cherry.)
53. <i>PTELEA TRIFOLIATA</i>	HOPTREE.
54. <i>PYRUS AMERICANA</i> (<i>Sorbus americana</i>)	MOUNTAIN ASH.
55. <i>PYRUS CORONARIA</i> (<i>Malus coronaria</i>)	SWEET CRAB.
56. <i>QUERCUS ALBA</i>	WHITE OAK. (Stave Oak.)
57. <i>QUERCUS MACROCARPA</i>	BUR OAK. (Mossy Cup Oak; Blue Oak.)
58. <i>QUERCUS PRINUS</i>	CHESTNUT OAK.
59. <i>QUERCUS ACUMINATA</i>	CHINQUAPIN OAK.
60. <i>QUERCUS RUBRA</i>	RED OAK. (Black Oak; Spanish Oak.)
61. <i>QUERCUS COCCINEA</i>	SCARLET OAK. (Red Oak; Black Oak.)
62. <i>QUERCUS PALUSTRIS</i>	PIN OAK. (Swamp Spanish Oak; Swamp Oak; Water Oak.)
63. <i>QUERCUS PLATANOIDES</i> (<i>Quercus bicolor</i>)	SWAMP WHITE OAK. (Swamp Oak.)
64. <i>QUERCUS VELUTINA</i> (<i>Quercus tinctoria</i>)	YELLOW OAK. (Black Oak.)
65. <i>RHUS HIRTA</i>	STAGHORN SUMACH.
66. <i>SALIX NIGRA</i>	BLACK WILLOW. (Willow.)
67. <i>SALIX AMYGDALOIDES</i>	ALMONDLEAF WILLOW. (Willow.)
68. <i>SALIX FLUVIATILIS</i> (<i>Salix longifolia</i>)	LONGLEAF WILLOW. (Sandbar Willow.)
69. <i>SALIX DISCOLOR</i>	GLAUCOUS WILLOW. (Pussy Willow; Willow.)
70. <i>SALIX CORDATA MACKENZIANA</i>	MACKENZIE WILLOW. (Heart-leaved Willow.)
71. <i>SASSAFRAS SASSAFRAS</i> (<i>Sassafras officinale</i>)	SASSAFRAS. (Sassifrax; Sassafac.)
72. <i>THUYA OCCIDENTALIS</i>	ARBORVITAE. (White Cedar; Cedar; American Arbor Vitae.)
73. <i>TILIA AMERICANA</i>	BASSWOOD. (Linden; American Linden; Whitewood.)
74. <i>TSUGA CANADENSIS</i>	HEMLOCK. (Hemlock Spruce; Spruce.)
75. <i>ULMUS PUBESCENS</i> (<i>Ulmus fulva</i>)	SLIPPERY ELM. (Red Elm.)
76. <i>ULMUS AMERICANA</i>	WHITE ELM. (Soft Elm; Swamp Elm.)
77. <i>ULMUS RACEMOSA</i>	ROCK ELM. (Cork Elm; White Elm.)

TREES INTRODUCED FROM UNITED STATES.

<i>Scientific Name.</i>	<i>Common Name.</i>
<i>ABIES CONCOLOR</i>	WHITE FIR. (Balsam Fir.)
<i>ABIES NOBILIS</i>	NOBLE FIR. (Red Fir.)
<i>AESCULUS GLABRA</i>	OHIO BUCKEYE. (Buckeye.)
<i>BETULA POPULIFOLIA</i>	WHITE BIRCH. (Gray Birch.)
<i>CATALPA CATALPA</i> (<i>Catalpa bignonioides</i>)	CATALPA.
<i>CATALPA SPECIOSA</i>	HARDY CATALPA.
<i>CHAMAECYPARIS THYOIDES</i> (<i>Chamaecyparis sphaeroidea</i>)	WHITE CEDAR. (Swamp Cedar; Juniper.)
<i>COTINUS COTINOIDES</i> (<i>Rhus cotinoides</i>)	AMERICAN SMOKE-TREE.
<i>GLEDITSIA TRIACANTHOS</i>	HONEY LOCUST.
<i>PICEA ENGELMANNI</i>	ENGELMANN SPRUCE.
<i>PICEA ARYANA</i> (<i>Picea pungens</i>)	BLUE SPRUCE. (Colorado Blue Spruce.)
<i>PINUS PONDEROSA</i>	BULL PINE. (Yellow Pine.)
<i>PSEUDOTSUGA TAXIFOLIA</i> (<i>Pseudotsuga douglassii</i>)	DOUGLAS SPRUCE. (Red Fir; Douglas Fir.)
<i>ROBINIA PSEUDACACIA</i>	BLACK LOCUST. (Locust.)



Fig. 1.—Sugar maple woodlot, showing good reproduction.

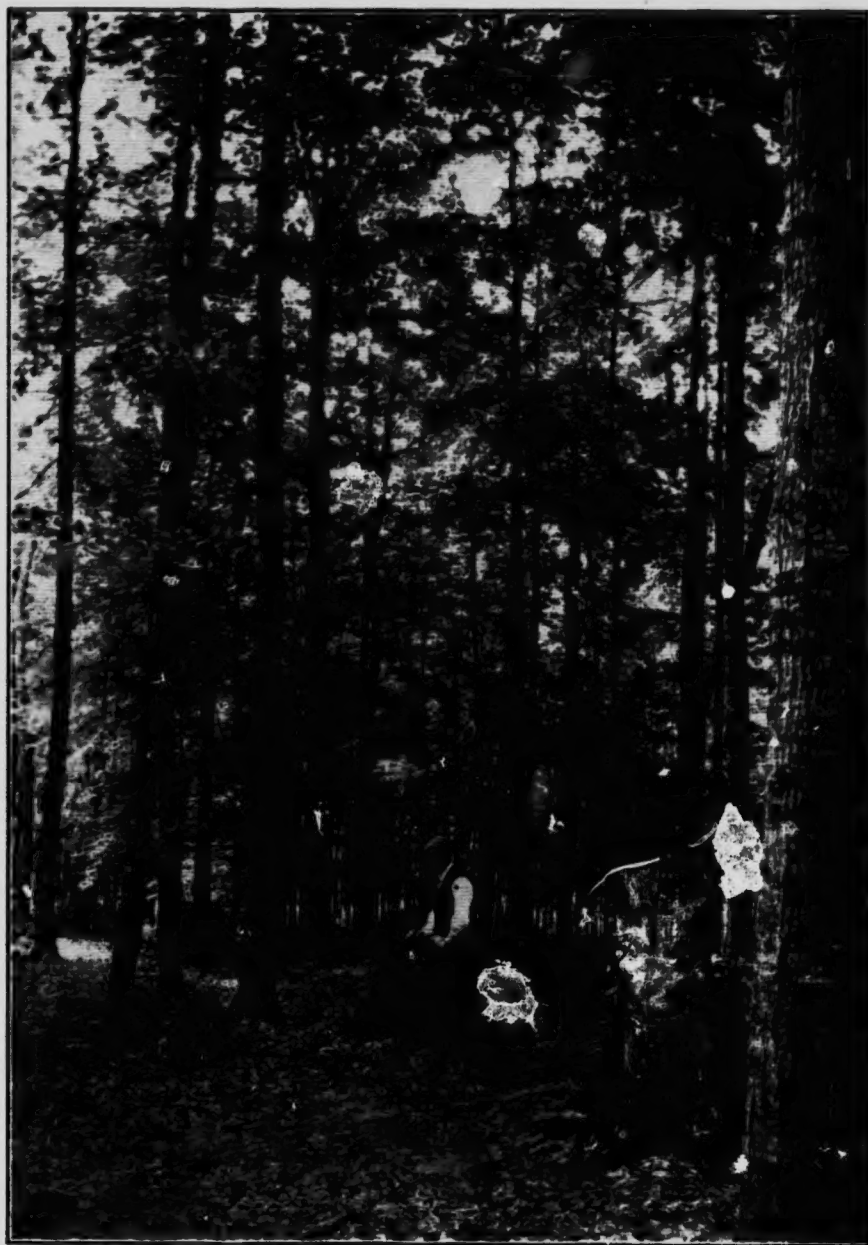


Fig. 2.—Original pinery, now covered with woodlot of hardwood—
as maple, beech and ash.

TREES INTRODUCED FROM OTHER COUNTRIES.

<i>Scientific Name.</i>	<i>Common Name.</i>
1. ABIES NORDMANNIANA	NORMANN'S FIR.
2. ACER PSEUDO-PLATMUS	PLANE TREE. (Sycamore.)
3. ACER PLATANOIDES	NORWAY MAPLE.
4. AESCULUS HIPPOCASTANUM	HORSE-CHESTNUT.
5. AILANTHUS GLANDULOSA (China).....	AILANTHUS.
6. BETULA ALBA	SILVER BIRCH.
7. CARPINUS BETULUS	EUROPEAN HORNBEAM.
8. FAGUS SYLVATICA	EUROPEAN BEECH.
9. FRAXINUS EXCELSIOR	EUROPEAN ASH.
10. GINGKO BILOBA (China).....	GINGKO. (Japanese Maidenhair Tree.)
11. JUGLANS REGIA	EUROPEAN WALNUT.
12. LARIX EUROPAEA	LARCH.
13. MORUS ALBA (China).....	WHITE MULBERRY.
14. PINUS AUSTRIACA	BLACK OF AUSTRIAN PINE.
15. PINUS SYLVESTRIS	SCOTCH PINE.
16. PINUS MUGHO	MUCHO PINE.
17. PICEA EXCELSA	NORWAY SPRUCE.
18. POPULUS ALBA	WHITE POPLAR.
19. POPULUS PYRAMIDALIS	LOMBARDY POPLAR.
20. QUERCUS PEDUNCULATA	ENGLISH OAK.
21. SALIX ALBA	WHITE WILLOW.
22. SALIX FRAGILIS	CRACK WILLOW.
23. TILIA EUROPAEA	LINDEN. (Lime-tree.)
24. ULMUS CAMPESTRIS	ENGLISH ELM.
25. ULMUS MONTANA	SCOTS OF WYCH ELM.

THE WOODLOT.

INTRODUCTION.

The forest has been spoken of as an organism, and the forest tree finds its best development as one of a community. Soil conditions, leaf litter, vegetable mould or humus, undergrowth and the influence of the trees upon each other are all important factors in the proper development of the forest tree. The woodlot, being small in area, often lacks protection, and there is great difficulty in keeping the above factors properly balanced.

The woodlot is a part of the farm which in too many cases has been neglected and looked upon as of no real value in its relation to the farm. It has furnished the owner with fuel and building material and frequently revenue by the sale of a few logs to the local mill. In many cases, however, the woodlot has not been considered as being a permanent resource or a necessary part of the farm economy.

In early days the woodlot was considered important as being a source of fuel, but when the farmer discovered the charms of anthracite coal one of the most evident arguments in favor of its existence seemed to pass away. At the present time many farmers in older Ontario depend almost entirely upon the supply of coal for fuel. Local mill operators have frequently been allowed to go through the woodlot and take out the best timber, leaving only a slash. The owner has felt satisfied with the ready cash that such an operation left him and quick returns is a strong argument in favor of denuding the land.

No arguments are advanced in these pages to show that the use of the land for wood crop production would give greater financial returns than its use for other farm purposes. Neither will we discuss the percentage of land which should be under trees, as this is a question which must be settled by the individual owner. Many farmers in Ontario find that from the standpoint of labor and management they are limited in the amount of land which they can profitably cultivate.

The following pages take it for granted that the owner desires to make the woodlot a permanent and paying part of the farm.

GROUND FIRES AS RELATED TO THE WOODLOT.

Injury to Soil. Fire should never be allowed to run through the woodlot. By burning off the leaf litter and vegetable mould or humus the soil is greatly weakened. As was pointed out in previous pages, the healthy development of the forest is dependent upon the humus condition of the soil.

Injury to Reproduction. Ground fires also destroy the seed and young growth and make it much more difficult for seeds to germinate in the future. The



Fig. 3.—Effects of ground fires on white oak.

natural seedbed of humus soil covered with the leaves gives a protected, natural seedbed which is necessary for reproduction.

Injury to Old Trees. Ground fires frequently pass through the woods in spring and by the middle of the summer the woods seem to have recovered. This is not the case, for usually large trees, which seem to have bark thick enough to withstand the small amount of heat of a ground fire, are injured in a manner not at once visible to the observer. The heat from a ground fire, which it seems is too small to injure a tree with heavy bark, frequently affects the tree very seriously. The injury is of two kinds.

By burning off the humus and litter the soil is left unprotected so that it lacks moisture during the dry season, as well as weakening the soil in regard to

food supply for the trees. Frequently the burning kills the shallow roots or leaves them unprotected.

The living tissue beneath the bark of the tree close to the ground becomes so heated that it is either killed or partly destroyed. The first visible effect may be seen in the form of a fungous growth about the base of the tree. This parasitic fungus gradually weakens the tree, making it subject to insect pests, and finally causing its death, but the real and first cause was the innocent-looking ground fire.

STOCK GRAZING.

Probably one of the most serious hindrances to the proper growth and development in the woodlot has been caused by grazing. There were many, a few years ago, who claimed that grazing did not injure the woodlot.



Fig. 4.—Showing grazed woodlot on the left, and protected woodlot on the right.

Experience has shown, however, that in the Ontario woodlot grazing must always be injurious. Many examples, as in Fig. 4, may be seen in Ontario where the comparison of grazed and ungrazed woodlots show the result. While the injury is admitted by many, there are those who claim that the woodlot is of more value in protecting the cattle during the heat of the day and giving them pasturage than for wood-producing purposes. It is very difficult to compare the rental value of the woodlot used for purposes of pasturage and that of the woodlot used exclusively for wood production. One thing is certain, that to have a permanent woodlot, where conditions are favorable for tree growth the stock must be excluded.

Domestic animals are frequently classed as to the amount of injury they inflict on the woodlot. From the standpoint of browsing the degree of injury may be placed in the following order: Goats and sheep, horses, cattle, swine, the first mentioned being the most injurious and the last being least.

Injurious effects of allowing stock to run in the woodlot may be discussed in its relation to the soil, the reproduction of young growth and the older trees.



Fig. 5.—Tops of trees dying from effects of stock grazing.

Soil. While the effects of grazing on the soil may be least noticeable, it is very important. Destruction of young growth soon opens the woodlot to drying winds which carry off the humus-forming leaves and greatly lessen the moisture content of the soil. Light begins to enter and reach the ground, causing grass and weeds to start which soon develop a stiff sod. Trampling of the soil causes it to become impervious, thus allowing the water to run off rapidly instead of being held in the soil as is the case in normal conditions. After these unfavorable conditions have come to prevail, the tree seeds find it very hard to germinate and soon there is no reproduction taking place.

Young Growth. The leaves and tender branches of the young growth in the woodlot are eagerly browsed by the animals. Some species of trees are less liable to browsing than others. The Ironwood seems to be particularly immune from browsing, so that in many Ontario woodlots that have been grazed the larger percentage of the young growth is composed of Ironwood.

Cattle have been noticed standing in good, fresh clover, greedily devouring the leaves from limbs of Sugar Maple which were thrown into the pasture. Evidently they enjoyed a change in diet.

Old Trees. The trampling of the soil, the destruction of young growth, which should protect the soil from sun and wind, and the formation of an impervious sod, all aid in lessening the vigor of growth of the standing, full grown trees. In this case the injurious effects are scarcely noticeable to the common observer owing to his lack of knowledge as to what healthy tree growth actually means. The annual amount of wood production is far below what it should be when the soil conditions are in an abnormal state from grazing.

Many woodlots contain trees that have not reached maturity, but whose tops are dying. Such trees are spoken of as being stag-headed. Stag-headedness is caused by lack of nourishment and moisture in the soil, a result of grazing.

WEED TREES.

Many woodlots contain a large percentage of weed trees or inferior species. Weed trees such as Ironwood, Hawthorn, and Blue Beech have gradually taken possession as an undergrowth.

Everything seems to favor the development of these species. In cutting operations these trees are seldom disturbed. The stock in grazing prefer the leaves and branches of the better species, thus giving these weed trees another advantage. The seedlings of the Ironwood and Blue Beech seem very hardy and vigorous and can stand a great amount of shade, so that they get an early start in the struggle for possession of the soil. When once the Ironwood has obtained a footing its dense foliage so shades the ground that better species cannot develop beneath it. In many woodlots from seventy-five to eighty per cent. of the trees under three inches are made up of Ironwood.

INFERIOR SPECIES.

The question of the inferiority of a species is relative and depends on local conditions.

Inferior species, as Poplars and Slippery or Red Elm, are often growing on soils which are capable of producing much better species. Then in some cases the woodlot has gradually become filled with Sugar Maple when it might be wise to introduce other species.

DEFECTIVE AND OVERMATURE TREES.

The average woodlot contains many defective and overmature trees. The defective trees are of various descriptions. Trees with old fire scars, trees injured while young by the felling of neighboring trees, trees wantonly scarred by the careless blow of an axe, trees broken and deformed by wind or snow, are all forms which should gradually be removed. Overmature trees frequently show a tendency to become stag-headed, and if left standing gradually deteriorate in value. Such trees are a menace to the surrounding growth and frequently in felling destroy more than their own value.

IMPROVEMENT CUTTING.

Cutting operations which aim to overcome the above defects, namely, weed trees, inferior species, defective and overmature trees are spoken of as "improvement cuttings."

In the farm woodlot all cutting for firewood should be made from such trees. It is not to be understood that it is advisable to go through the woods and cut down all the above mentioned trees without regard to the future of the area thus cut over. The first consideration should be to protect the soil, that is, do not cut

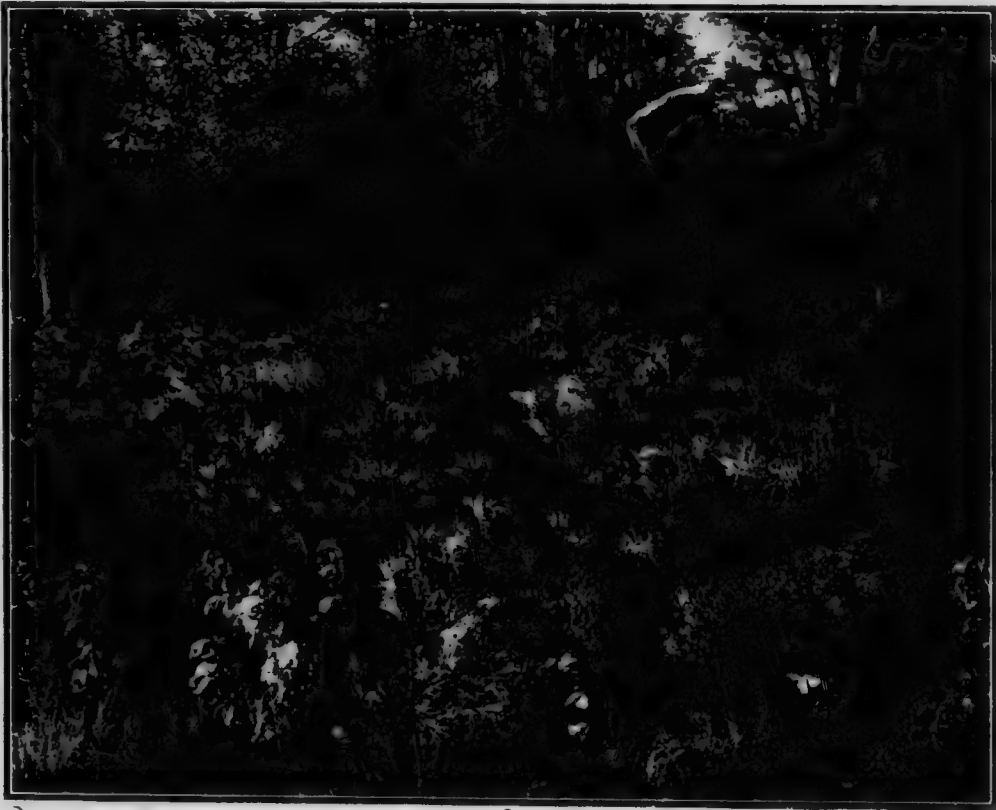


Fig. 6.—White Pine, planted in open spot in the woodlot.

down a tree or a group of trees unless you are certain that there will follow another crop. If you do not get reproduction the following season it is almost certain that grass and weeds will come in and the soil will soon lose its valuable character as related to tree growth. Whether you can depend on the area reproducing from the seed of neighboring trees or whether it will be necessary to use artificial means can only be judged by local considerations.

THIN BORDERS AND OPEN SPOTS.

The borders of woodlots become thin owing to various factors. This outside portion of the woods is more subject to winds and storms which cause windfalls, dry out the soil and blow away the leaves which should go to form vegetable mould. Frequently the border is overcut, as the owner does not trouble going to the in-

terior of the woods for his fuel, etc. In time the soil deteriorates, grass and weeds follow, and then we have the characteristic border which is neither woodland nor pasture.

The development of large open grassy spots in the woodlot is usually due to the effects of grazing. The old trees have been taken out and the young growth destroyed by the stock until grass has taken possession and formed an impervious sod in which the tree seeds find it impossible to develop.

The above conditions may be improved in the case of the thin borders by planting evergreens or coniferous trees about the border in order to form a wind-break. Norway Spruce and White Pine will be found to be two of the best species for this purpose. One or two rows of White Pine planted along the fences, especially on the west side of the woods, which is the side most subject to winds in Ontario, would make a splendid protection.

Open spots in the woods if covered with grass could be improved by roughly breaking the sod and allowing the seeds to reach the mineral soil. Such breaking can be done with a disk-harrow or plow. In some cases where there is no young growth to injure, it may be advisable to turn in hogs as they frequently make a good seedbed by their rooting in search of grubs, seeds, etc.

These measures are to be adopted when the surrounding trees are bearing seed. If there is little chance of such areas being seeded from neighboring trees, or if the owner desires to introduce better species into his woodlot, he may resort to planting.

Planting of this nature may be done by using the young plants or by sowing seed. With the exception of nut trees, it will be advisable to use plants rather than seed. Methods of planting the woodlot are similar to the methods of planting described elsewhere. While the general methods are similar, there are many bare spots which may need special attention owing to the small amount of light which is able to reach the ground. When breaking the sod with disk or plow is impracticable it is usually possible to break spots about twelve to fifteen inches square with the mattock. In these spots nuts can be dibbled or plants inserted.

The success of planting and the vigor of growth depends on the question of light as well as the condition of the soil. In general the locations that have enough light to allow a development of grass may be successfully filled with young tree growth.

The woodlot should have a definite boundary with a belt of evergreens especially on the side from which the prevailing winds come. Too many woodlots have no definite boundary, but are surrounded by slash. Keep a definite boundary well stocked with trees and soon the woodlot will have every acre productive.

COPPICE.

Coppice is a form of growth in the woodlot which is little understood by the average owner. Trees are reproduced from seed, cuttings, suckers and shoots, Coppice growth originates from shoots or suckers developing from the stump or root collar of previous trees. The new shoots depend upon the root system of the original tree for nourishment. In Fig. 1, one-year-old shoots may be seen which have developed from a Chestnut stump. All native deciduous or hardwood trees have the power of reproducing in this way, especially where trees are cut young and at the proper season. Evergreens, with a few exceptions, as *Arborvitæ*, never reproduce in this way. Certain species, as Chestnut, Basswood, the Oaks, Elm,

Poplar, Birch and Soft Maples seem to develop these shoots more freely and vigorously than other species.

In many woodlots, especially in the southern part of the Province, a large percentage of the growth is of this nature rather than of seedling origin. Fig. 8 shows at least two generations of coppice. An old chestnut stump about three feet in diameter has, growing from its base, a coppice Chestnut about twenty-six inches in diameter, and from this is growing a six-inch Chestnut which is the third generation. The twenty-six-inch tree developed from the root-system of the old stump, but in time produced a root system of its own which is now helping to support the six-inch tree. In this case the coppice is developing before the parent tree has been cut. In Fig. 7 the coppice probably developed after cutting of the parent tree.



Fig. 7.--One-year-old Chestnut Coppice.

To obtain good tree growth of coppice after cutting certain considerations must be given attention.

Age of Parent Tree. Coppice from overmature trees will not produce strong growth, as the old root system has lost its vigor. Coppice loses its vigor of growth by following the system too far, the third and fourth generations becoming weak and decrepit. In many woodlots dwarfed and stunted growth exists from the above causes.

Time of Cutting. Coppice is best produced by cutting in late winter or early spring. Late fall or early winter cutting often allows frost and moisture to loosen the bark. The coppice shoots originate beneath this outer bark, and if it is destroyed there is small chance of shoots developing.

Height of Stump. In cutting with a view of obtaining coppice, the stump should be cut as closely to the ground as possible. It is desirable to obtain result-

ing shoots as near the ground as possible. Coppice which originates high up in the stump does not become vigorous. Frequently we find trees in the woodlot with the base partly rotted, and such trees are often of coppice origin. In this case the shoots developed from a high point on the original stump with the result that as the old stump decayed the new coppice growth was left weakened at the point of contact.



Fig. 8.—Three generations of Chestnut Coppice.

Number of Sprouts on Stump. As may be seen in Fig. 8, a great many sprouts may develop from one stump. It will be found that in a few years a few of these will outgrow the others. Not more than three of these sprouts should be left for a final crop. After the first year a large proportion of the poorer sprouts could be cut out, care being taken not to injure the others. In another year or

two the rest of the poorer sprouts should be taken out, leaving two or three of the strongest. Those to remain should be chosen with regard to their location on the stump, having thought as to what their future development will be.

Frequency of Application. As was pointed out, coppice loses its vigor of reproducing after a few cuttings. When two or three generations of trees of coppice origin have been taken off it is advisable to endeavor to obtain new growth of seedling origin. Nuts may be dibbled in where favorable spots can be found, or planting may be resorted to if desired. In any case the area should be gradually restocked with trees of seedling origin.



Fig. 9.—Chestnut Coppice, five years old, in need of thinning.

FOREST TREE PLANTING.

INTRODUCTION.

The rapid disappearance of the forest from southern Ontario has brought many to feel the advisability of reforestation. In the days when the forest was an obstacle to agricultural development there were many hillsides, ridges and other forms of poor soil cleared, which would have been better left under forest conditions.

As the nature of forest planting becomes better understood many will undertake this work who at present are deterred by the fear of cost or lack of knowledge. Many confuse forest planting with park or orchard planting, and do not understand how plantations can be made within reasonable costs. In forest planting small plants, with well formed roots especially adapted for transplanting, are used, and the operation of planting is much more simple than that of orchard planting. The following pages will endeavor to describe the various operations employed in forest planting.

TIME OF PLANTING.

The transplanting or moving of a plant should be done at a time when it will least interfere with its growth. If the transplanting can be carried on without disturbing the soil about the roots and without subjecting the plant in its new surroundings to adverse conditions, the operation might be performed almost any month of the year.

In the rough operation of forest planting, the plant must be handled at a season when it is in a dormant condition. For the climatic conditions of Southern



Fig. 10 illustrates a plantation of Scotch Pine made about twenty-five years ago. This was a gravelly hillside of small value for cultivation. At a very small cost it was replanted, and to-day is a valuable asset to the farm.

Ontario, the early spring seems to be the most suitable season for this work. The end of April to the end of May will in general be the safest time, in spring, to plant.

Planting of evergreens may also be successfully carried on between the middle of August and the middle of September. Where there is no winter protection, and the young plants are subject to the sudden changes, without a snow cover, as often happens in southern Ontario, fall planting may receive considerable injury.

Transplanting larger, ornamental evergreens is done at other seasons than those mentioned above, but this form of planting must not be confused with forest planting.

MATERIAL FOR PLANTING.

The possibility of successful forest planting at a low cost depends largely upon the size and quality of the plant used in the operation. In reforesting, a small plant is used with a well-developed root-system, as shown in Fig. 11.

The small plant can be produced at a low cost, and it can be placed in the ground with little labor. In handling and transplanting the small plant there is

little injury to the root-system, so that it has better chances of becoming established than a larger plant or tree.

CARE OF PLANTING MATERIAL IN HANDLING.

The protection of the plant, from the time it leaves the nursery until it is safely placed in its final location, is very important. The roots of trees (especially of evergreens) are very liable to injury from wind and sun and should be protected from drying out.



Fig. 11.—Common size of evergreen transplant ready for final planting. Note the stocky tops and fibrous root-systems, which enable the plant to stand adverse conditions; White Pine on the left, Scotch Pine on right.

When nursery stock is transferred from the nursery lines direct to the planting area, the roots can be protected by layering in wet moss, chaff, or by the use of wet burlap.

Where the prospective planter receives his nursery stock from a distance by freight or express, it should not be left lying at the office any longer than possible. The trees should be unpacked at convenient places on or near the ground to be planted. The plants are usually tied in bunches of 50 or 100. In taking them out the roots should be dipped in water, the burlap opened up, and then "heeled in," which is illustrated in Fig. 12. If possible the trees should be "heeled

in" in protected spots and near water. If it is impossible to find spots protected from the wind and the plants have to remain "heeled in" for several days it will be advantageous to place some sort of windbreak protection about the plants. They will remain without injury for several days if "heeled in" properly.

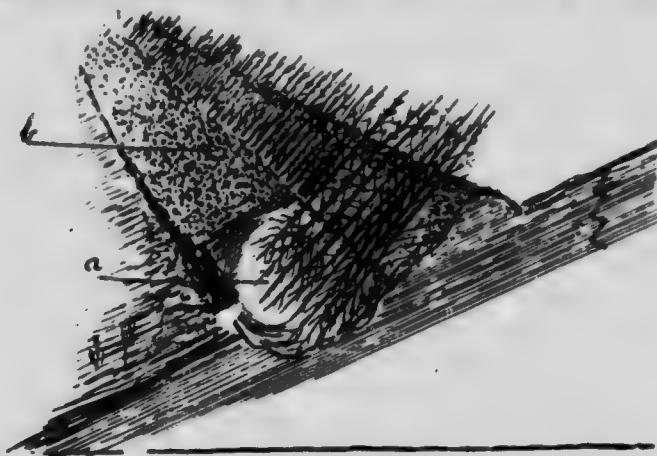


Fig. 12.—Heeling in plants. Roots of the plants are placed in trench (a), and then firmly covered with soil (b).

SPACING OF THE PLANTS.

In forest planting it is necessary to plant many more trees than will eventually be found in a mature forest. If trees with clean, tall stems are desired, it will be necessary to plant close in order to kill off the side branches and force the trees in height growth.



Fig. 13.—Showing the bad effects of too wide planting. Note the development of large limbs close to the ground. This plantation is of Austrian Pine, in which the lower branches do not easily die.

Everyone is familiar with the short trunk and large branch or crown development of trees growing in the open as compared to the clean-stemmed forest-grown tree. By close planting, the energy of the tree, during early life is forced into height growth.

Close planting also gives earlier soil protection, preventing the growth of grass and weeds. Most soils lack in humus or vegetable mould content and close planting in most cases improves the soil in this regard, soon giving natural forest soil conditions. The different kinds of trees vary in their ability to produce clean stems. This is owing to the fact that some species of trees will stand much more shade than others.



Fig. 14.—Note the clean stems in this European Larch plantation. These trees were planted 5 x 5 feet. The Larch demands plenty of light, and the lower branches die out comparatively easily.

For most of the trees with which we are interested in Ontario, the spacing should not be over six feet each way, and in general, it will be safe to use 5 by 5 feet in spacing.

Where hardwoods as White Ash, Elm, Maple, Oak and Chestnut are being planted upon cultivated soil and where the planting material is cheap and the operation can be done at a low cost, it will pay to plant even as close as 4 x 4 feet apart each way, so that soil protection may be obtained as early as possible.

Number of plants required to plant an acre in squares:—

3 ft. x 3 ft.	4,840 plants.
4 ft. x 4 ft.	2,722 "
5 ft. x 5 ft.	1,742 "
6 ft. x 6 ft.	1,210 "

The area may be planted in regular lines if the roughness of the site does not prevent it, but if the land is broken by stumps, rocks, etc., it will be necessary to distribute the plants wherever possible.

The more regularly the planting is done the easier it will be to find and protect the plant and to replace dead plants if necessary. The following diagrams illustrate two methods of regular distribution over an area, although in ordinary planting the spacing must be carried out in a rough manner. Alternate distribution takes more plants for an acre, but gives the individual plant more growing space.

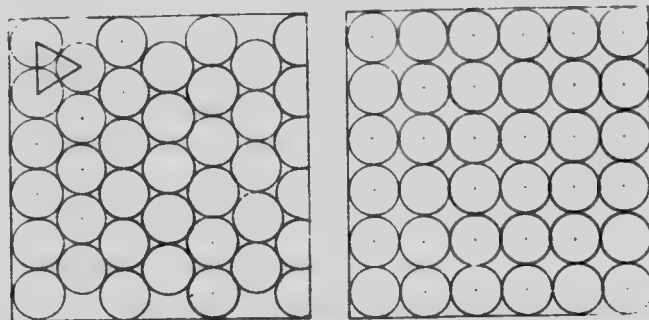


Fig. 15.—Two methods of spacing plants—alternate and opposite.

PREPARATION OF SOIL AND METHODS OF PLANTING.

In Ontario, forest planting will usually be done on soils unfit for agriculture, where it will be impossible to cultivate. Forest planting on large areas as a purely commercial proposition would likely preclude cultivation, even if possible, as the initial expenditures in this work must be kept as low as possible.

Occasions may arise when cultivation of the soil will be advisable where financial investment is not the chief consideration, and where the equipment and work can be obtained as on the average farm. Where cultivation is advisable the land should be fallowed and the planting may be done similar to that described in the following pages.

Planting may be done by running furrows in which the plants should be placed before the soil has time to become dry. If the soil is so loose that it will not "hold up" in the furrow, allowing the roots to be properly placed, then the planting may be done as in Fig. 22.

In most cases cultivation for one or two years will give the trees such a start that the grass and weeds will not afterwards interfere with their development. Some slow growing trees may need cultivation a little longer, but this question must, in the end, be judged on the spot.

On rough land or soil which would wash if cultivated, planting furrows may be run out as shown in Figs. 16, 17, 18.



Fig. 16.—Shallow plow furrows for forest planting. run upon sandy-loam hillsides.

These furrows should be as shallow as possible so that the roots in planting will not be placed below the good soil. The plant should be placed near the heel



Fig. 17.—Showing the use of shallow plow furrows in forest planting.

of the furrow as shown in Fig. 18, where it will be protected for a while against grass and will receive some protection from wind.

In cases of running furrows of this nature on a hillside, plowing should commence on the highest point, so that rolling turf will not interfere with the operations. Furrows should not be run with the slope or "up and down" the hill as washing might occur. If cases arise where this cannot be avoided it would be well to throw pieces of turf back into the furrow to prevent chances of washing.

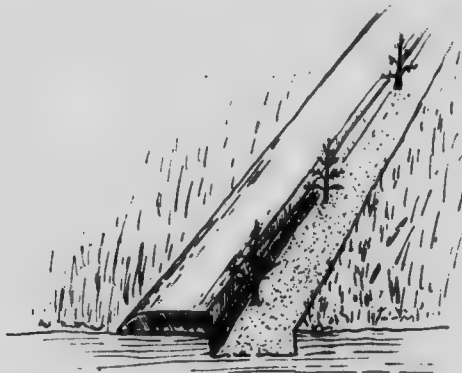


Fig. 18.—Shallow planting furrow, showing plants placed on the protected side.

The plants should be transferred from the spot where they are "heeled in" or packed, to the planting hole by carrying in a pail. Usually the plants are small enough so that 100 or 200 can be carried in a 12-quart pail as shown in Fig. 20.

This pail should be filled with enough water so that the roots will be well covered. It is often recommended that the roots should be puddled before planting. The writer has found that a satisfactory puddle can be made only when dealing with a heavy, clay soil. Ordinary soils, common to forest planting, settle

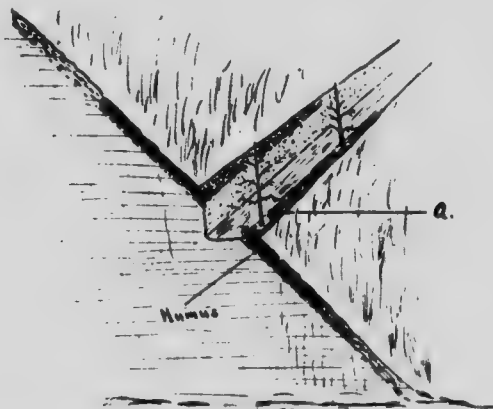


Fig. 19.—Furrow on hillside, showing plant placed in good soil at (a).

to the bottom of the pail and only increase its weight. Plants should be transferred direct from the pail to the planting hole and not dropped ahead of the planter.

Planting can best be done by two working together, one preparing the planting hole, the other placing the plant and covering it. The planting hole may be



Fig. 20.—Showing the use of the pail in carrying plants along planting line.



Fig. 21.—Planting on loose, sandy soil where only the spade is needed, and where planting gangs of two prove most satisfactory. One man opens the hole, the other places the plant and firms the soil about the roots.

made in several ways, depending upon the looseness of the soil. In comparatively loose soil the planting hole may be made by driving in the spade and moving it backward and forward as shown in Fig. 22. In some cases there is danger of an air space being left at the lower point of the spade, and this should be guarded

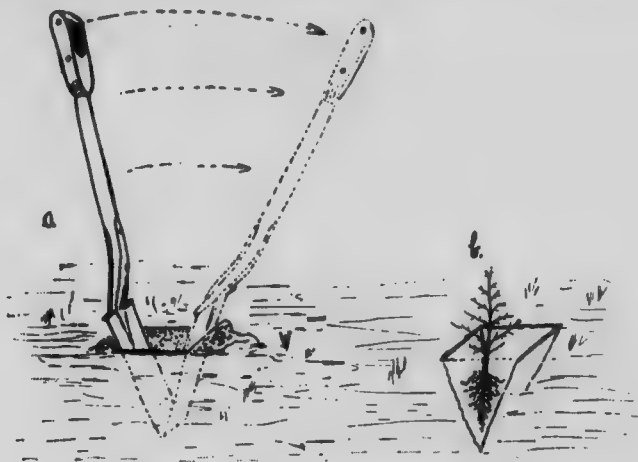


Fig. 22.—Planting in loose soil.

against. If the soil is very loose and sandy, the plant may need to be placed in position before the spade is removed to prevent the filling up of the planting hole.

The planting hole may also be made by using the mattock or grub hoe. (Fig. 23). The soil is loosened with one of these tools and the planting hole can be made with the broad edge of the tool.

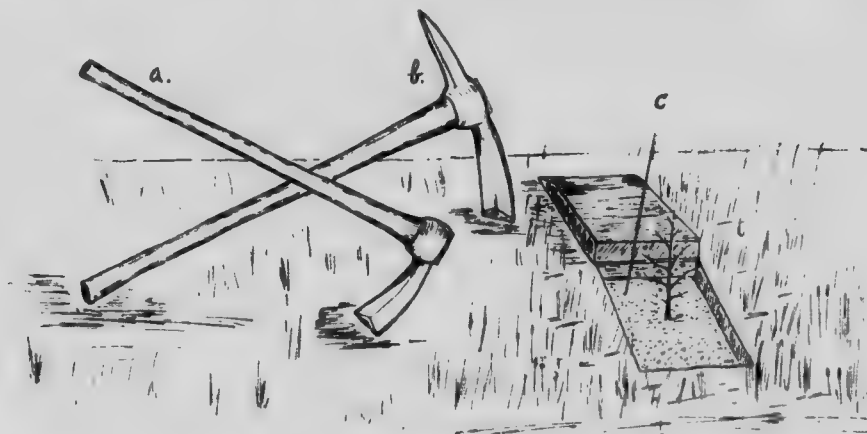


Fig. 23.—(a) Grub hoe. (b) Planting mattock. (c) Sod removed from planting hole.

If it is desired to plant in rough conditions where the running of furrows is impracticable, other methods may be followed. Where there exists a dense turf in stony soils the mattock or grub hoe (Fig. 23), may be of great service. The sod can be cut off with the grub hoe or mattock and the soil loosened with a pick,

or in case of using the mattock by using the picklike part of the mattock. In very rough planting one man can handle the mattock and prepare the planting



Fig. 24.—Showing use of mattock in planting on rough ground with stiff turf.

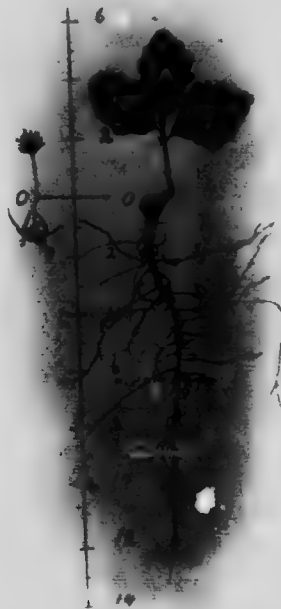


Fig. 25.—Showing root development of one-year-old white pine and red oak.

spot, another e the planting hole with the spade, and a third do the planting. However, no te rules can aid down, and the arrangement must be settled

for the individual case. In some lands it might take two men with mattocks to, prepare ground for one planter.

PLANTING OF NUTS.

Species which have seeds and seedlings subject to many dangers if sown in rough, wild places should be reproduced by using the nursery plant.

Many of the nut tree species, however, can best be propagated by planting the nuts in final position rather than by using nursery stock. Nut tree seedlings are generally quite hardy after germination, making it quite safe to plant them in rough places.

The common nut trees growing in Ontario are White Oak, Bur Oak, Red Oak, Black Oak, Beech, Chestnut, Bitternut Hickory, Shagbark Hickory, Butternut, and Black Walnut. Of the above species, Red Oak and Chestnut give promise of being the most useful and practical in waste lands, especially where the soil is light and sandy. Red Oak, White Oak, Chestnut, Shagbark Hickory, and Black Walnut are found naturally in loamy soils. Bur Oak and Bitternut Hickory are found in the heavier classes of soils.

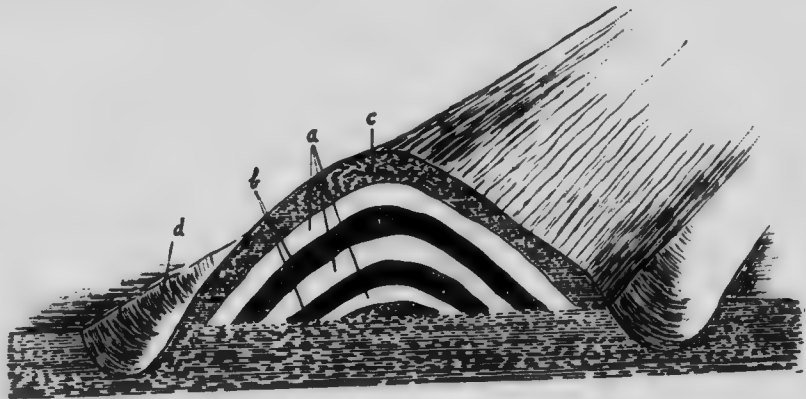


Fig. 26.—Cross section of pit for storing nuts.

The collecting of nut seeds need not be described, as everyone has had some experience. Care should be had not to gather such nuts as Black Walnuts too green. The safest time to collect is after the nuts have naturally fallen to the ground.

White Oak acorns in the southern part of the Province frequently germinate in the autumn shortly after falling. Acorns which have started to germinate will need careful treatment in handling. If the acorns are collected upon falling to the ground and placed in a cool, dry place, there will be little danger of autumn germination.

Nuts may be planted in the autumn or stored and planted in the spring. Autumn planting has some drawbacks. The edible nuts are frequently found by squirrels or other rodents before they have germinated. In wet soils and cold, damp seasons the nuts may lose their germinating power from decay.

The care and storage of nuts needs some attention. The nut may have the husk taken off, although there is less danger of drying out if it is not removed. Drying out is the greatest danger to be feared after nuts have been collected. In no case should they be placed in artificially heated rooms. After collection the nuts should be spread out in some dry, cool place for a few days until they are

well matured. Care should be taken both in storing and maturing not to leave nuts piled so deep that they might heat. While maturing they should be turned over occasionally.

Seed may be stored by putting them on a well drained spot and covering them with leaves or hay over which may be placed a light covering of brush. Storing in a pit, as shown in Fig. 26, is a safe method. Layers of nuts (*a*) six to ten inches deep covered with leaves or small twigs (*b*) and topped off with soil (*c*) three to four inches in depth, provides good storage. A light covering of brush or hay over the pit will prevent washing of the top dressing of soil. A ditch at the side, as in Fig. 26, (*d*), will give drainage. The bottom of the ditch should be well below the general level.



Fig. 27.—Proper and improper methods of attaching wire fence to tree.

Nuts can also be safely stored by stratifying them in sand. Stratifying seed is done by making a layer of sand and then a layer of seed mixed with sand. This may be done in a well-drained trench or in a box. In the case of storing in a box the box should be covered lightly with soil. If left standing unprotected it will dry out and injure the seed.

The preparation of the planting area will be similar to that described in previous pages. Where planting is to be done in sod it will be necessary to cut away a square of sod, as in Fig. 23. Planting the nut is very simple and may be done with a sharp-pointed stick or dibble. With this instrument a hole is made in the planting spot and the nut dropped in. In loose soils the nut can be sufficiently covered by a stamp of the heel. When the soil is heavy it may be necessary

to cover the nut by prodding with the dibble. The nut should be planted deeper in loose than in heavy soils. The depth should be made from two to three inches, depending upon the looseness of the soil.

Red Oak and Black Walnut should not be planted alone to form a plantation. These species do not form crown cover or canopy enough to protect the soil and obtain the desirable forest soil condition. Mixtures of Red Oak and White Pine will probably give good results, although our lack of experience with native species makes it difficult to advise mixtures. In many waste lands there are spots in which the soil is better than that of the general area. In waste sand lands there are frequently low areas where the moisture content of the soil is better than the average. In planting such lands where the White Pine is being used to stock the area, these spots could be filled with Red Oak.



Fig. 28.—Stock protection clump of White Elm and Box Elder in the background.

PLANTING IN SWAMP OR MARSHY LAND.

Frequently there exists on the farm a portion of low or swamp land which has been cleared of trees, but which cannot be drained satisfactorily for cultivation.

Swamp land planting presents certain difficulties which make it advisable to give definite instruction as to treatment. When continual overflowing exists during spring or rainy seasons, little can be done in the way of practical planting. Before spending time or money in swamp planting the possibilities of future drainage should be considered. Many swamp soils, when drained, will become valuable agricultural lands. In exceptional cases, where tree growth is desired, mounds can be thrown up on which lowland species can be planted.

In most Ontario types of swampland there exist many spots which are higher and better drained than the main part of the swamp. On such spots, in the natural conditions in Ontario, we frequently find White Pine thriving well. The better class of such spots may be planted with White Pine, White Spruce, *Arborvitæ*, White Elm, Red Maple and Silver Maple. The poorer parts of the area may be stocked by using cuttings or slips of Poplar and Willow.

PLANTING CLUMPS FOR PROTECTION OF STOCK.

On stock and dairy farms clumps of trees afford valuable protection during the heat of the day. It is a common sight to see animals retreat to the shelter of trees which may happen to stand in the field. In permanent pastures and even in fields occasionally used for pasturage small clumps of trees could be planted in corners on waste portions of the field if any existed. It would be necessary to fence in such planting and give it protection till the trees reached a size of three or four inches in diameter.

Deciduous trees as Box Elder, White Elm, or Soft Maples, would be best suited for such work. Box Elder and White Elm grow fast, develop plenty of shade, and stand the abuse to which they must be subjected by the animals.



Fig. 29.—Protection belt sheltering peach orchard.

PROTECTION BELTS.

Belts or rows of trees are frequently planted for protection to orchards, fields or buildings. There is no doubt about the advantage of such planting. Stock in protected barns will need less feed. Protected houses will need less fuel. Orchard or field crops benefit by having protection. The drying winds of summer do less harm where tree protection exists. Orchards heavy with fruit are often protected so that loss from wind-falls and broken branches is lessened. Protected fields of clover, fall wheat, etc., hold the snow longer in the spring, which gives protection from frosts and loss of moisture by evaporation.

Throughout the Province of Ontario the prevailing winds are westerly, which should be taken into consideration in planting shelter belts. That is, to protect buildings or fields it is wise to plant on west, southwest and northwest sides.

The most satisfactory protection is to be had by planting evergreens, as Norway Spruce or native White Spruce. These evergreens give protection both summer and winter by forming a dense growth down to the ground. Arborvitæ, Hemlock and White Pine are sometimes used in such planting, but the spruces are the best.

Where one row of Spruce is to be planted, the trees should be spaced from six to ten feet apart. When two rows are desired the trees should be eight to ten feet apart in the row and the rows eight feet apart. The trees should be planted alternately as in Fig. 15. Where trees are to be planted as a protection to buildings, it may be advisable to plant a mixture of evergreens in clumps rather than a straight row of Spruce. This would require more space, but would have a better appearance. In such planting the trees should not be planted too near the building, as they may become a nuisance when full grown.



Fig. 30.—Sandy ridge at Provincial Forest Station being planted with Scotch and Jack Pine in 1909.

Planting material may be of two kinds. Small seedlings from ten to twelve inches in height, or transplants which may be anywhere from ten inches to several feet in height. If the prospective planter does not feel like paying prices for large transplants it may be of advantage to buy the small seedling or transplant and keep it a year or so in the garden where it can be cultivated till ready for final planting. Ten to twelve-inch plants can be put in the garden in rows twelve to eighteen inches apart and ten to twelve inches apart in the row. Planting can be done as described in previous pages.

PLANTING ALONG PERMANENT FENCES.

The question of securing fence posts at a reasonable rate and their short life after being placed in the ground is a problem confronting the agriculturist in

Ontario. One solution of the problem may be found in planting trees along permanent fences. In a short time it will be possible to attach the wires to these trees.

The trees can be planted every sixteen feet or even every eight feet as the owner desires. Strong, vigorous plants should be chosen for such work, and in case of using evergreens, transplants should be used as the fence lines are frequently filled with dense grass and weeds which will endanger the young plant. More attention can be given the making of planting holes and the actual planting than in the case of waste plant planting. Where a rail fence now exists and there is no chance to cultivate, the planting hole should be made by cutting away a large sod about two feet square, as in Fig. 23. Occasionally it may be practical to cultivate a strip four to six feet wide along a fence which can be moved a few feet after the trees have grown. Preparation of this strip by summer fallowing will give results in



Fig. 31.—The 1909 plantation as shown in Fig. 30 after six years' growth. This photo taken in 1914.

future tree growth which will repay the effort. Whether planting is done in planting holes or on a prepared strip, future cultivation will give best results. This cultivation should be carried on for two years at least—longer will pay—until the trees have become well established. It will be an advantage to mulch the trees with grass or old manure. The trees should be inspected during the summer to see that weeds, etc., do not overshadow them. In case the owner does not want large trees along cultivated fields, the first planting can be done every sixteen feet and a few years later trees can be planted between. When the first trees become too large they can be cut off the height of a common fence post and later the fence can be attached to the younger generation of trees as the older ones decay.

The choice of species for this work must be given some consideration. The fastest growing species will be Box Elder, Hardy Catalpa, and Black Locust. In the southern portions of the Province and in the best classes of fresh, moist soils

Hardy Catalpa may prove valuable for this purpose. Black Locust will grow on the poorest of locations and will be of more general value than Hardy Catalpa. Sugar Maple may be employed in this work, although the growth will be slower than the preceding species and it requires very good soil. Some may desire to plant nut-producing trees so that a return may be had from nut crops. Black Walnut, Shag-bark Hickory, and Chestnut would be the most valuable in this case. The Chestnut would grow on the lighter soil while the Black Walnut should be planted in good, rich soil. If evergreens are desired, Norway Spruce, White Spruce, Larch and Arborvitæ will give best results. The Arborvitæ should be placed in moist soil, while Larch will stand dry, poor locations.

In placing wire on trees, care should be taken not to injure the tree more than necessary. Fig. 27 shows two methods common in Ontario. Where the strip of wood is used in which to place staples, the tree gradually forces the strip over the head of the nail and in time it may be necessary to put in new nails. As a rule, large bolts or heavy spikes are used to fasten this strip to the tree. The use of such large fastenings is unnecessary and usually a much smaller nail will hold just as well. For an inch and a half strip two and a half inch nails are sufficiently large.